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A study of the causes of non-compliance by patients prescribed eyedrops

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Abstract

An investigation into the causes of non-compliance by patients using eyedrops has been undertaken by questionnaire, ability tests, and by tests on eyedrop bottles. The results indicate a high prevalence of non-compliance, compounded by an inability adequately to instil a drop into the eye. About half the patients had difficulty aiming the drop, and other problems including squeezing the bottle, blinking, and seeing the tip of the bottle. Ability tests included a measurement of the grip strength of patients to complement measurement of the force required to expel a drop from a bottle. Some patients, particularly those with arthritis, could not generate enough force to squeeze a bottle. These same patients also had difficulty with the other movements required to administer drops. While some attempts have been made to produce devices to assist with eyedrops which can improve the aim of the patient, none give assistance in expelling a drop. An additional problem found was the reluctance of patients to admit to medical staff that they experienced any difficulty with their drops.

It is well established that complience of patients with a prescribed treatment is often inadequate. This may be due to a complex interaction of factors, prime among them being lack of knowledge, inability, or disinterest. Eye preparations are no exception.[1] Several teams have undertaken studies in an attempt both to enumerate the extent of the problem and to understand its origin.

One approach has been to use a special drop bottle with an electronic device to record drop administration. In one study[2] such a device showed that 41% of patients missed six or more doses over a 30-day period. A similar study[3] found that over half the patients missed 20% of their prescribed doses. Other studies have relied on interview[4,5] and observation[6,7] and have produced similar results. All these studies were undertaken with patients regularly using eyedrops for glaucoma, one of them[6] indicating that 13% of patients observed were unable to place drops in both eyes after several attempts.

Interviewing patients using eyedrops after cataract surgery[8,9] revealed a similar range of problems and non-compliance. Other workers have also demonstrated problems with drop size, reporting a wide variation in drop size from commercial eye drops[10] and variation in the number of drops actually expelled by patients.[7]

Collectively these studies have shown that many patients have experienced difficulties in self-administration of eyedrops. Some possible reasons for this have been elucidated and some 'at risk' groups identified.[11] Many of the problems appear to be physical, that is, related to the ability of the patient to aim a drop accurately into the conjunctival sac. To help them several devices have been used and reported on. Letocha[12] reviewed those available in 1985, which all attempted to help the patient aim more effectively. One was a plastic support device,[13] another consisted of modified sunglasses,[14] while another had a system of mirrors to help the patient see the dropper tip.[15] Later published ideas have included a modified glasses frame[16] and a cone shaped device to support and direct the dropper.[17] The reports do not indicate whether the devices were successful in achieving their objective. However, it appears that their design was based on perception of a problem rather than on detailed analysis of factors involved. In addition one manufacturer has modified the bottle to assist in expelling a drop (MSD Ocumeter).

A review[18] has reported that there are several problems which patients experience and which lead to non-compliance and concluded that it is therefore unlikely that one answer will be found. Because of the relative lack of published evidence it was decided to undertake a study aimed at elucidating the physical problems experienced by patients during eyedrop administration and from the results to derive guidance on the features required by a compliance aid.

Material and methods

Information was obtained by questioning patients, by ability tests, and by a physical evaluation of eyedrop bottles.

QUESTIONNAIRE

For the questioning the interviewer deliberately created an informal, relaxed atmosphere before asking a series of open-ended questions. Where possible, discussion was allowed to develop. In this way 200 patients attending the Eye Outpatients Department at Aberdeen Royal Infirmary were interviewed irrespective of their condition, only provided they were using eyedrops. The questions used explored the patients' knowledge of their condition and its treatment, whether their compliance was good or bad and the reasons for this, how they administered their drops, any problems encountered, and whether they would welcome a compliance aid if a suitable one was available.

ABILITY TESTS

Thirty patients in the eye surgery ward at

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Woodend Hospital, Aberdeen, agreed to undergo a series of ability tests. 10 ml bottles of hypromellose eyedrops *BNF* were used.

(1) Patients were asked to expel one drop into a preweighed vial. The increase in weight was recorded.

(2) A sheet with a series of concentric circles was used as a target. With the wrist resting on a block at a height of 4 cm the patients were asked to place a drop on the centre of the target.

(3) The patients were asked to instil a drop of hypromellose into one eye of their choice unaided. They were asked to repeat the process using the Easidrop.

(4) A dynamometer (Vigorimeter) was used to measure the pressure of squeeze exerted by finger and thumb (as on a bottle) and by the full hand.

EVALUATION OF BOTTLE

A test rig was used to measure the force required to expel drops of hypromellose from 5, 10, and 20 ml bottles (Cascelloid Division, BXL Containers Ltd). The force was applied at the midpoint on the bottle side, away from the seam. Further tests, on 10 ml bottles only, were carried out to find the effects of the bottle seam, the position of applying the force on the bottle side, the quantity of liquid in the bottle, and the storage temperature on the force required to expel a drop.

Results and discussion

QUESTIONNAIRE

The patients (average age 62, range 9–92) were being treated for glaucoma (32%), following surgery (25%), dry eye (10%), irritation and injury (10%), conjunctivitis, ulcers, and other conditions. Most knew the nature of their condition (96%) and were satisfied with their understanding of it.

Compliance patterns are shown in Table I. Any assessment of a compliance level is unreliable. By using a relaxed approach it was hoped that patients would be more open than in a more formal situation. Their readiness to admit problems and shortcomings would indicate a good level of accuracy and reliability in their responses. This being the case, 75% of patients complied well with instructions. Those who did not admitted a poor motivation owing to not understanding the function of the drops or an inability to use them. This finding suggests that if patients are well informed, as they were in this sample, their motivation is not a major problem in achieving compliance.

Table 1 Patterns of compliance in administration of eyedrops

Compliance	*Number of patients*
Used drops as directed	128 (64%)
Missed an occasional dose	24 (12%)
Missed up to two doses per week	32 (16%)
Other responses	16 (8%)
Administered own drops	124 (62%)
Did so if no one else available	34 (17%)
Always obtained assistance	42 (21%)
Had never tried self administration	16 (8%)

Table 2 Problems encountered by patients during self medication with eyedrops

Problem	*% Patients*
Directing the bottle (miss frequently)	36
Directing the bottle (miss occasionally)	13
Shaky hand	8
Squeezing the bottle	20
Blinking	12
Poor visibility of tip of dropper	13
Prodding eye with tip of dropper	9
Reading labels and identifying bottle	14

Over a third of patients did not administer their own drops regularly, with 21% always using assistance. Within this latter group, 8% had never tried self administration, 4% found it took too long, while the remaining 9% had tried but lacked the ability to place the drop in their eye. In total, 57% of patients admitted having some difficulty administering their drops. The main problems are presented in Table II. Discussion with patients indicated that lack of confidence was a major factor, particularly fear of prodding the eye. As a result the bottle was often held too far from the eye, making the aim more difficult and encouraging the blink reflex. Older patients experienced physical problems in raising the arm, tilting the head, and in holding and squeezing the bottle. Some patients found breaking the tamper-proof seal on a new bottle difficult.

The possibility of a compliance aid was welcomed by 78% of patients, but none were aware that any aids were available. Surprisingly, 72% said that the interview was the first time that they had been asked whether they had problems, while 69% said that they would not tell a doctor of their problems even if asked. This reluctance on behalf of patients was reflected in the lack of awareness among medical staff of the problems experienced by the patients.

ABILITY TESTS

(1) The weight of eyedrop solution in each vial varied from 0·03 g to 0·07 g (mean 0·39 g). Several patients expelled more than one drop.

(2) Most patients said they thought they had aimed the target well. The results are presented in Table III.

(3) Only six patients (20%) instilled a drop unaided first time. This was increased to 26 (87%) with the Easidrop device. This latter figure may be artificially high because all the patients were laid flat or almost flat so that no head-tilting was necessary.

(4) The patients had a wide range of grip strength. The pressure recorded was converted to a force based on the area of the Vigorimeter

Table 3 Accuracy of aim of patients as measured by means of target 4 cm below wrist height

Distance from centre of target	*Number of patients*
Within 1·5 cm (simulating eye)	9
Between 1·5 cm and 3 cm	14
Greater than 3 cm	7

bulb. The finger and thumb forces varied from 8·35–100·2 N, while full grip values were between 15·03 and 183·7 N. Thus the force is roughly doubled by using a full grip.

EVALUATION OF BOTTLES

Data for the average force required to expel a drop are presented in Table IV. A wide spread of results was obtained from the bottles tested, not just between bottles but also depending on the number of previous squeezes or whether it had been held in the hand for a few minutes. So at best these results can give only an indication of the forces required to expel a drop in various situations. Storage in a fridge, or pressing on the seam, increased slightly the force required. However, there was a marked increase as a bottle was progressively emptied, presumably because of the higher compressibility of air than the hypromellose solution.

The real significance of the results becomes obvious when these forces are compared with the force which the patients were able to exert. For most there was no problem, but some (approximately 13% of our sample) could not expel a drop from the bottle. (The questionnaire sample gave a higher figure of 20%.) In general these patients are those who have arthritic conditions, which also reduces their ability to raise the dropper to their eye. It may be physically impossible for this group to self-administer their drops without some additional aid.

For patients who were marginal in their ability to expel drops a second problem emerged from both the questionnaire and the ability tests. As the force being applied approached the limit of their capability, so the wobble of the hand increased. The questionnaire suggested that a further 8% were affected in this way, while observation of the practical tests suggested a much higher figure (approaching 50%). From these data it appears that 25%–50% of patients using eyedrops may have severe physical difficulty in administering them. This will manifest itself in failure to apply them, administering more than one drop (also reported by Kass,[7]), or opting out and either not trying or using a second person (30% of patients). A shaking hand affected the ability of some patients to aim accurately. The ability tests (Table III) showed that only 30% of patients could place a drop within 1·5 cm of the centre of a target (that figure taken to be the approximate size of the eye), and 47% were within 3 cm. This test was carried out in front of the patients, who could clearly see what they were doing. Corroborative evidence came from the questionnaire, where 49% admitted to missing the eye at least occasionally, and from the observation of patients placing drops in the eye, where only 20% managed it first time.

From this work it appears that we have identified two interrelated problems with the self administration of eyedrops: firstly, the lack of physical acuity, and secondly the inability to aim adequately. At present there is in the UK only one aid to assist with administering eyedrops – the Easidrop (produced by Quoteforce, UK). This screws on to the standard bottle neck until the dropper tip is level with a guide mark and, being shaped like an eyebath with cut-away sides, directs the tip of the bottle towards, but clear of, the eye. It will, therefore, improve the aim of patients – as was found in the ability tests – though it does not adequately account for gravity in a non-supine patient. Thus patients have to tilt their head back a long way, which may be difficult for those who are elderly or arthritic. It also reduces the related problem of prodding the eye and lack of visibility of the tip, but does not help in expelling a drop. Several devices aimed at improving application have been described,[12–17] but they are all concerned only with improving the aim.

Table 4 Average force required to expel a drop from an eyedrop bottle at the midpoint on the side away from the seam at room temperature (unless stated to the contrary)

Bottle/condition	Average force required (N)
5 ml	13·24
10 ml	11·76
20 ml	8·82
10 ml stored in fridge	13·22
10 ml midline on seam	12·84
10 ml half empty	17·64

Apart from the evidence we have produced, demographic trends indicate that the number of patients experiencing difficulty will increase rather than decrease. Difficulty in administering drops increases with age. Projections indicate that the population of 85 years old and above will increase by a third over the next 10 years. Unless many of the patients are able to self-administer eyedrops, very heavy demands will be placed on health service resources. Twelve years ago it was estimated that there were 100 000 cases of chronic open-angle glaucoma.[4] This figure will have increased, and it takes no account of other conditions requiring the use of eyedrops. Because of this we have taken steps to develop an aid which will assist with the problems identified – namely, aim, tilting the head, squeezing the bottle, seeing the drop approaching the eye. It will also help in breaking the tamper-proof seal. A prototype device (Fig 1) is currently undergoing evaluation with patients in both community and hospital. If any compliance aid is to be beneficial, the patient must be aware of its existence. In our questionnaire we found a very disturbing reluctance on the part of patients to

Figure 1 The Opticare compliance aid, developed as a result of this study in an attempt to ease the problems experienced in the self administration of eyedrops. The device is currently undergoing evaluation with patients.

tell the doctor about any problems they had. Probably as a consequence of this we also found medical staff were less aware of their patients' problems than is desirable. No doubt the barrier to free communication can be broken down if doctors take a lead. There is probably also a need for an 'awareness campaign' aimed at patients, so that they do not feel guilty or inadequate because they have problems administering their eye-drops. The availability of a suitable device will also help patients achieve safe administration and improve compliance.

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